SS_j (j=1 . . . M), adjusted gaze position ACG is obtained using mapping function $F\mathbf{1}_j'$. The adjustment to $F\mathbf{1}_j$ to obtain adjusted $F\mathbf{1}_j'$ should be such that CG and ACG are the same. This is similar to the example above, except that the adjustment is applied at a subspace level. The adjustments can be in the form of applying a respective offset to each of mapping function F**1** or recalculating each of the mapping functions between the scan subspaces and the target space. (If forward and reverse scan subspaces are used, act **470** may instead include determining adjusted mapping functions $F(F)_1'$, $F\mathbf{1}(F)_2'$, . . . , $F\mathbf{1}(F)_M'$ between forward scan subspaces $SS(F)_1$, $SS(F)_2$, . . . , $SS(F)_M$ and the target space TS based on the calibrating gaze positions $CG(F)_1$, $CG(F)_2$, . . . , $CG(F)_M$ and determining adjusted mapping functions $F\mathbf{1}(R)_1'$, $F\mathbf{1}(R)_2'$, . . . , $F\mathbf{1}(R)_M'$ between reverse scan subspaces $SS(R)_1$, $SS(R)_2$, . . . , $SS(R)_M$ and the target space TS.)

Each of the mapping functions $F\mathbf{2}_1$, $F\mathbf{2}_2$, . . . , $F\mathbf{2}_M$ mentioned above may be determined beforehand in a calibration process. A general procedure for determining mapping functions $F\mathbf{2}_1$, $F\mathbf{2}_2$, . . . , $F\mathbf{2}_M$ may include displaying markers in the target space in a predetermined sequence. For each marker displayed, an eye focusing on the marker is scanned with infrared light, from M virtual light projectors, and reflection-position data (or pupil timing data) and/or glint timing data are collected. M images of the eye can be constructed for each marker position. A pupil can be detected from each image, and a pupil center position of the pupil can be determined. Alternatively, M pupil center positions can be determined from the pupil timing data. Thus, there will be M pupil center positions for each marker position. Also, there will be M glint center positions for each marker position if only M primary glints are considered. From the pupil center positions and glint center positions, M glint-pupil vectors can be determined for each marker position. M glint-pupil vector subspaces can be defined, each of the glint-pupil vector subspaces containing one glint-pupil vector corresponding to each marker position. Each set of glint-pupil vectors in a glint-pupil vector subspace and corresponding marker positions provide "subspace vector calibration data". There will M sets of such sub-subspace vector calibration data to determine mapping functions. Each of the sub-subspace vector calibration data sets can be used to determine a respective one of mapping functions $F\mathbf{2}_1$, $F\mathbf{2}_2$, . . . , $F\mathbf{2}_M$. The mapping functions $F\mathbf{2}_1$, $F\mathbf{2}_2$, . . . , $F\mathbf{2}_M$ may be determined by, for example, applying geometric transformations, affine transformations, or neural networks to the subspace vector calibration data. (If forward and reverse scan subspaces are used, there would be M sets of forward subspace vector calibration data and M sets of reverse subspace vector calibration data. The mapping functions $F\mathbf{2}(F)_j$ and $F\mathbf{2}(R)_j$, where j=1 . . . M, would be determined from the M sets of forward subspace vector calibration data and the M sets of reverse subspace vector calibration data, respectively.)

Eye tracking system **100** may be integrated into a wearable heads-up display to enable the wearable heads-up display to obtain scan data from the eye while the user is wearing the wearable heads-up display. The wearable heads-up display may use the scan data for various purposes, such as eye tracking, user authentication, and monitoring one or more conditions of the user while the user is operating the wearable heads-up display, or the wearable heads-up display may simply collect and store the scan data for future analysis.

FIG. **9** shows one example of the eye tracking system (**100** in FIG. **1**) integrated into a wearable heads-up display system **500**. The reference numbers of the eye tracking system used in FIG. **1** have been retained in FIG. **9** for continuity. The display part of the wearable heads-up display system includes a scanning light projector **504** that is operable to scan visible light over a target area. Scanning light projector **504** includes a laser module **508**, which includes visible laser diodes, e.g., red laser diode (R), green laser diode (G), and blue laser diode (B), to provide visible light. In general, laser module **508** may have any number and combination of laser diodes, or visible light sources, to provide visible light. Scanning light projector **504** includes an optical scanner **512**, which is positioned, oriented, and operable to receive visible light from laser module **508**. Optical scanner **512** may include at least one scan mirror, which may be a 2D scan mirror or two orthogonally-oriented mono-axis mirrors. Display engine **520** provides controls to laser module **508** and optical scanner **512** according to display content to be projected to a target space in a field of view of eye **200**. The display part of the wearable heads-up display system includes an optical splitter **532**, which may have the same structure as optical splitter **132** of the eye tracking system, but for visible light. That is, optical splitter **532** has N optical elements with facets to create N virtual light projectors from which visible light can be projected to the eye. The eye tracking system uses M virtual light projectors to form M illumination areas on the eye, whereas the display system uses N virtual light projectors to project content to the N exit pupils formed proximate eye **200**. In this example, both M and N are greater than 1. However, since the optical systems for the eye tracking system and the display system are decoupled, M does not have to be the same as N.

The display part of the wearable heads-up display includes an optical combiner **540** that is aligned to receive visible light from the optical splitter **532**. In one example, optical combiner **540** may be a wavelength-multiplexed holographic optical element. In other examples, optical combiner **540** may be an angle-multiplexed holographic optical element or an angle- and wavelength-multiplexed holographic optical element. Optical combiner **540** may include at least one visible hologram that is responsive to visible light and unresponsive to infrared light. Optical combiner **540** receives visible light from the N virtual light projectors created by optical splitter **532** and directs the visible light to the N exit pupils formed proximate eye **200**. Optical combiner **140** for infrared light and optical combiner **540** for visible light may be integrated into a single lens **510**, such as an eyeglass.

In the wearable heads-up display system of FIG. **9**, processor **128** may provide a frame buffer containing display content to display engine **520**, which then uses the display content to generate controls for the visible laser diodes in laser module **504** and for the optical scanner **512**. Laser module **508** generates visible light signals, which are directed to optical scanner **512**. Optical scanner **512** deflects the visible light signals, and optical splitter **532** receives the deflected signals from optical scanner **512**. Each facet of optical splitter **532** directs a subset of the visible light signals received by the optical splitter **532** to optical combiner **540**, which redirects the subset of the visible light signals to a respective exit pupil proximate eye **200**. The visible light signals enter eye **200**, forming a virtual display in a target space in a field of view of eye **200**. While scanning light projector **504** is projecting content to exit pupils at eye **200**, the eye tracking system may be operated to track the gaze position of eye **200** relative to the target space. The eye tracking function includes projecting infrared light signals